Surgical Lip Augmentation – An Overview

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Abstract

Over the past few decades, fuller lips have been considered a desirable trait. Numerous therapeutic options exist for aesthetic lip augmentation, ranging from temporary and permanent injectable fillers to implants and other surgical techniques.This article discusses lip augmentation, including fillers, surgery etc. as correction for this process. Composition of the various fillers is discussed in conjunction with their respective outcomes and duration of effect.

KEY WORDS: lip augmentation, hydroxyapatites, Alloderm, Expanded polytetrafluoro-ethylene (ePTFE)

Introduction

Since a long time, implants have been used for augmenting lips and have included a plethora of materials. Contemporary choices included fat, silastic, polyethylene, bovine collagen, human collagen, hydroxyapatites,acrylic microspheres, lactic acid, dermis, fascia and lately Expanded polytetrafluoro-ethylene (ePTFE) and Silicone. [1]
An accurate physical examination determines the specific area of deficiency or desired enhancement. Specifically, evaluate the patient's occlusion, maxillary-mandibular relations, and aging pattern. A general evaluation of the relation between the upper lip and the incisors reveals the appropriate course of action.
Lip augmentation consists of the reshaping and/or enlargement of the visible portion of the lip, the vermillion. Alteration of the shape of the Cupid's bow and of the relation between the vermillion and the skin underlying the nasal columella also fall within the category of lip augmentation.Also important is to consider the relationship between lip height and incisor show in the anatomic analysis. Evaluate possible maxillary hypoplasia and protrusion and consider the patient's occlusion status.

The following algorithm approach is done for physical evaluation prior to lip augmentation:

· Optimal incisor show - Conservative augmentation by fat transfer or dermis fat graft
· Excessive incisor show - Augmentation by fat transfer or dermis fat graft
· Inadequate incisor show, long lip - Lip shortening and lift with incision at nasal base ("buffalo horn") in young patients with acute columella-labial angle or incision at vermillion border in older patients with perioral rhytids
· Inadequate incisor show, normal lip length - Maxillary lengthening with possible lip augmentation

Surgical lip augmentation can be achieved by injectable fillers, implants,and surgical advancement, roll, or lift. Autografts, such as fat and dermis, have been used to fill soft-tissue defects for both aesthetic and reconstructive needs [2]. Various alloplasts, such as polymeric silicone (Silastic; Dow Corning), and GoreTex (W.L. Gore and Assoc., Inc., Flagstaff, AZ, U.S.A.), also have been described for soft-tissue augmentation (3-5).

Each autograft or alloplast has both favorable and unfavorable characteristics. The ideal material would be biocompatible, easy to fixate, and without evidence of infection, rejection, or resorption. The material would be inexpensive and would not require additional costly procedures for harvesting. Fat grafts are easy to obtain, but survival of fat as a transplanted material is questionable. (6) Dermal grafts have a better survival rate than fat grafts. However, autologous dermal grafts are more difficult to harvest and often leave noticeable donor scars and donor defects. The choice between autologous grafts and alloplasts for facial augmentation is complex.

Acellular dermal graft

Acellular human dermal allografts (AlloDerm, LifeCell Corporation, The Woodlands, TX, U.S.A.) have been used to treat burns (7-10), in oral and periodontal surgery, (11-12) and as an interpositional graft in septal perforation repair (13).

Many potential uses exist for acellular human dermal allografts. The indications for using AlloDerm in the face are increasing as surgeons become more comfortable with the material. Dermal allografts can be used to enhance soft tissues, such as in lip augmentation, to alleviate rhytids or grooves, in areas such as the glabella or melolabial fold, and to elevate depressed scars. AlloDerm grafts also can be used to camouflage contour deformities from loss of subcutaneous or dermal soft tissues.

Other creative uses for dermal allografts include interpositional grafts in septal-perforation repair and use as camouflaging agents in rhinoplasty patients with thin skin (13).

AlloDerm is available commercially and consists of decellularized donor dermis. Through a proprietary process, this material is produced in precut sizes and is available for implantation. Various reports are available, indicating that the decellularized dermis becomes a scaffolding for neovascular ingrowth, and full integration in the patient's tissues has beenverified experimentally.

Autologous dermis, dermal-fat, and fascia grafts are obtained from the patient, shaped, and implanted. In some patients, the grafts may be obtained from skin resected during local procedures such as lip lift or advancement, de-epithelialized, and then grafted.

AlloDerm dermal grafts are processed from human donor skin obtained from approved tissue banks. Donors are screened serologically for hepatitis Band C, human immunodeficiency virus types 1 and 2, human TIymphotrophic virus type I, and syphilis. Harvested skin is transported on ice in tissue-culture medium with supplemental antibiotics. The skin is incubated in a salt solution to remove the epidermal layer. The remaining dermis is washed in buffered detergent solutions to remove the cellular components. The decellularized collagen matrix is then washed and incubated in a cryoprotective solution. This solution preserves the biochemical and structural integrity of the dermal matrix. The acellular dermis is then packaged and freeze-dried. The packaged acellular allografts can be refrigerated and stored for 2 years. Rehydration of the freeze-dried graft is required before use of the dermal allograft material.

Lip Fillers

Over the millennia, various substances have been injected into the face, including wax, silicone, and animal products [14,15]. Contemporary cosmetic facial surgery includes many options to augment lips, folds, and wrinkles. For decades, bovine collagen has been the "gold standard" for facial filler augmentation in the United States[16].

An overview of injectable filler substances can be confusing. There exist many options, many fillers, many substances, many materials, and many claims of superiority. As stated earlier, bovine collagen (Zyplast, Zydenn; Inamed Corp., Santa Barbara, California) dominated the United States market for over 2 decades. Because these products were of bovine derivation, allergy testing was a prerequisite. Classically, patients were inoculated in the forearm with the material and, if no local allergic response was seen at 30 days, then the material was assumed safe. The need for testing proved to be a great drawback because many cosmetic consumers are spontaneous and want immediate treatment.

Injectable fillers

Lip augmentation with the use of injectable fillers allows quick results to be obtained with minimal downtime and repeatable applications. The most commonly used materials are collagen and autologous fat. Other materials and products used commonly include hyaluronic acid preparations such as Restylane or Perlane. Hyaluronic acid mixtures containing methylmethacrylate beads, such as Artecoll, allow for long-term lip augmentation, since after resorption of the hyaluronic acid the beads remain in the soft tissue permanently. Hyaluronic acid mixtures containing hydrogel particles, such as the product DermaLive, allow for long-term augmentation (>1 y) after resorption of the hyaluronic acid component due to permanence in the tissue of the synthetic hydrogel particles. Complex mixtures of hyaluronic acid and methylmethacrylate beads are available under the name Artecoll. Bioplastique is a filler available with similar characteristics consisting of 38% biphasic polymer textured silicone particles suspended in a 62% bioexcretable gel carrier. Significant ease of use, "off the shelf" availability, and widespread acceptance by the public make collagen one of the most common fillers used. Lip augmentation with collagen and other fillers can be performed by injecting the material in any or all of the anatomic parts of the lip, allowing for a very controlled and predictable result. Precautions regarding mode of injection and quantity of the substance injected vary widely within this family of products.

Autologous fat recently has become a more popular choice. The distinct advantage of fat as a volume

augmenter is that the results obtained are long lasting and in some cases permanent, depending on the amount of tissue injected and the location treated. Moreover, the risk of allergic reactions is avoided since the fat used is autologous tissue. Fat is obtained from the patient's donor site under local anesthesia, prepared with saline wash, decantation, or centrifugation, and then injected in the lips. As much as 30% of the injected fat can persist after transplantation with appropriate technique, and in some patients almost complete survival of the graft has been reported.

Hyaluronic acid (Restylane; Medicis, Scottsdale, Arizona), which has been used in many countries for over a decade, received Food and Drug Administration (FDA) approval in the United States in 2003.). This marketing release brought an onslaught of media attention that boosted the entire perception of and desire for fillers by the aging baby boomers.

Restylane comes packaged as 0.7 mL of a clear viscous gel with a supplied 3D-gauge needle.Restylane changed the paradigm for injectable fillers for numerous reasons. First, it is a nonanimal product (hyaluronic acid is a naturally occurring substance in humans [17]), which means that there is no reason for allergy testing, one of the biggest drawbacks of bovine collagen products. Second, studies showed that Restylane lasts longer than Zyplast. The longevity of Zyplast has long been a problem for patients.

Although the product was easy to use and produced an excellent result, it lasted only several months in most patients, whereas some studies showed Restylane can last up to 8 months [18,19]. One of the reasons for the extended longevity with Restylane is a process called isovolemic degradation.

Normally, collagen fillers are simply phagocytized and degraded, which causes decrease in volume. Hyaluronic acid undergoes isovolemic degradation. In this process, water is drawn into the filler molecule as the filler degrades. By doing this, the filler volume is retained longer as more water is continually drawn into the filler molecule[18].

The other major disadvantage of Restylane is formation of multiple granuloma on the lips post-operatively. Multiple studies have shown Restylane to be a safe and effective facial filler [19,20]. In 2003, Inamed introduced Cosmoplast and Cosmoderm, which are human collagen derivatives produced from human foreskin.[21] Because these products are of nonanimal origin, allergy testing is not necessary. Although these products are very easy to inject because they have excellent flow properties, the author, Joseph Niamtu[22] has found them to possess the same longevity as the bovine collagen predecessors.

Hyaluron (Inamed) gained FDA approval in 2004 and competes with Restylane in the new filler arena. Although the author, [23] has little experience with Hyaluron, differences lie in the fact that this hyaluronic acid product is derived from animals (rooster combs) and contains less hyaluronic acid per milliliter than Restylane.

Hydroxyapatite

Oral and maxillofacial surgeons have used hydroxyapatite products for augmentation for the past 20 years. Radiance FN (BioForm, Franksville, Wisconsin) is injectable filler that consists of hydroxyapatite micro spheres in a soluble gel vehicle.

The use of Radiance FN in cosmetic facial augmentation is off-label because the FDA approval for his product is for vocal cord plumping and as a radiopaque soft tissue marker. Joseph Niamtu [21] uses Radiance FN when requested by patients, primarily in the nasolabial folds and lips. The flow properties of Radiance FN are different from other fillers. The most noticeable property of Radiance FN is that a little product goes a long way. Because this product is hydroxyapetite based, the longevity is measured in years, not months. For this reason, overfill or asymmetry can be a huge problem because it persists for a long time.In general, the author uses 0.2 mL on each lip quadrant at a single sitting so as to not overfill. The patients are then seen several weeks later to see whether touch-up is necessary. Because Radiance FN is opaque, lip injection is visible on radiographs, and patients should be aware of this.

The injection of various lip fillers, the default filler used is Restylane; however, many patients present with a specific request for a filler that they desire. Other fillers used are Cosmoplast, Cosmoderm, Radiance FN, and Hyaluron. The most common requested site is the lips, followed by the nasolabial folds, the perioral region, cheek wrinkles, and "crew's feet" wrinkles. Due to the marketing hype, some patients confuse fillers with Botox. In addition, some patients desire massive rhytid injection, but because they have such a large amount of wrinkling, tbis would not be practical. These patients are informed that they would be better treated with lifting or resurfacing procedures.

In theory, fillers can be injected anywhere on the face; however, blindness has been reported with the periorbital injection of Zyplast and fat due to intravascular injection [24-25]. This rare but devastating complication calls attention to the care that must be exercised in this area. The surgeon should always inject very superficially, use the smallest gauge needle possible, and never use extreme plunger pressure on the syringe.

Although the injection of fillers is simple, many problems can result in terms of patient expectations and satisfaction. The main consideration is to accurately explain what the patient can expect as a treatment result. Because many patients have been "media victims," they present with unrealistic expectations, hoping for a miracle. Showing patients a series of before and after images for specific anatomic areas is one way to provide a reasonable expectation.

In addition, the injection of fillers should not be presented as a one-time procedure but as a treatment sequence to approach a result. Especially for some of the newer fillers such as Restylane that cause immediate swelling in the lips, judging the end point and symmetry can be difficult.

Every injector has his or her way of injecting fillers, but two recognized techniques are used universally. Linear threading involves inserting the needle and injection filler as a straight line while continuously moving in either a forward or backward direction. This process would be analogous to placing a line of toothpaste on one's toothbrush. The other injection method is known as the serial puncture technique. This involves placing small boluses of filler with multiple punctures along the lip or wrinkle. The wrinkle is filled by deposition of the small bolus of filler along the wrinkle and requires multiple needle sticks.

Augmenting wrinkles, lines, and folds

In addition to structural augmentation of the lips, injectable fillers are used to plump lines, folds, and wrinkles. As mentioned earlier, this process is practical for any given wrinkle, but some patients may present with severe rhytidosis and think that hundreds of wrinkles may be treated. Again, these patients must be educated to understand that they are better candidates for rhytidectomy or skin resurfacing.

Patients with many wrinkles can be candidates for injectable fillers, however, so long as they understand that selected wrinkles, lines, or folds can be treated.

When injecting the facial skin, most fillers are placed intradermally. One exception may be Radiance FN, which Niamtu[22] recommends placing somewhat deeper. Because Radiance FN is white and can lump easier than other fillers, using the deep dermis or even the subcutaneous plane is desirable. Restylane is the only nonanimal hyaluronic acid filler with FDA approval. Medicis offers several other fillers that are available in other countries. Perlane is similar to Restylane but has a larger particle size and is for deep dermal injection. The indication for this product is similar to Restylane, but due to the larger particle size, it must be injected deeper. Restylane Fine Line is another Medicis product. This product has a smaller particle size and is designed for more superficial dermal injection. Fine lines around the lip and crow's feet areas are common indications. This product corresponds to Cosmoderm, which has a smaller particle size than Cosmoplast. These products are human collagen derivatives. With the many choices of filler types and particle sizes, it is not uncommon for some practitioners to layer different types of fillers to achieve a desired result. Some practitioners may initially inject Perlane deep in the lip or fold and then inject Restylane more superficially. The same technique can be used with Cosmoplast injected deeply and Cosmoderm injected more superficially. The United States' experience is likely to mirror that of other countries, which means that many types and choices of fillers are likely to become available in the next several years.

Advanta implants

Surgical placement

Placing Advanta implants in the lip is a simple procedure, but strict adherence to several principles must be maintained. Use local anesthesia and topical anesthesia on the mucosa, followed by local anesthetic infiltration across the lip from commissure to commissure. It does not require much anesthetic solution to render the lips insensate, and it is important to not overinject the lip because the anesthetic volume will distort the lip and possibly skew the surgical judgment of placement.

Implant measurement

The Advanta implants for lip augmentation are available in various sizes and in round and oval configurations. In very small patients or those wanting minimal augmentation,4.0-mm implant is generally used. Oval is preferred over the round for the simple fact that oval provide different contour in the same area if twisted (if the oval implant does not lay flat, one part of the lip could be more augmented than the other).

The biggest pitfall is placing an implant in the lips that is too short. It is stated that the implant should be measured by placing it over the lips from one commissure to the other. After adequate local anesthesia, the implant is placed (which comes in I5-cm lengths) over the lip while the patient opens his or her mouth to the maximum opening. The implant should reach both commissures in some patients, a single I5-cm implant can supply enough material to augment both lips, but it is a mistake to try to obtain two implants from a single strand in all patients because some patients have longer lips and the implant will fall short.

The basic premise of implant placement is to make stab incisions at both commissures and to thread the implant through the lip. The implant may be pulled through the lip with multiple modalities including a passing awl and suture, a passing instrument such as a tendon passer, or an included trocar.

After adequate local anesthesia, a No. 11 scalpel blade is used to make a stab incision just medial to each commissure. It is important to make the length of this incision large enough to accommodate the implant without distorting it. If the incision is not long enough, then the implant will exhibit ductility and will be tapered along the leading edge, which will cause smaller augmentation on the leading edge and larger augmentation on the following edge.

Another important principle to adhere to is the level of placement of the implant. Basically, aim for the exact center of the lip to place the implant, which would be in a submuscular plane. If the implant is placed too superficially, then it will be visible and impede normal lip function. If the implant is placed too deeply, then the amount of augmentation is decreased and the labial artery is in jeopardy. The labial artery usually runs in the posterior one third of the lip (when viewed in cross-section) and is at the level of the anterior incisal plane in the lower lip [26]. After the stab incisions are made, the implant is threaded. Use a tendon passer (Byron Mentor, Byron Medical, Tucson, AZ) to thread the implant.

Step 1 is to thread the implant from the entrance incision and out the exit incision.

Again, it is imperative to remain in the same plane in the middle of the lip. As the tendon passer is advanced, the lip bunches. After the tendon passer is passed through the exit incision, the lip will need to be stretched to its normal length.

Passing this instrument will make a tunnel. The size of this tunnel should be just slightly smaller than the implant diameter. If the tunnel is too wide, then the implant will migrate; if too small, the implant will not lie correctly. A blunt instrument such as a knitting needle may be used to dilate the tunnel if necessary.

Step 2 is to taper the edges of the implant to facilitate the threading and the position of the implant tail at the commissure.

Step 3 is to firmly grab the implant at the leading tapered edge and pull it through the tunnel. Having a tendon passer with teeth is helpful because it takes significant traction to pull the implant through the tunnel; it will frequently slip off the instrument if not firmly secured.

Step 4 is to restrech the lip to its normal length to accommodate the implant in a natural lip position. It is important to make sure that the tapered implant tails lie deep in the incision, just shy of the commissure, and do not extend outside of the incision. The final step is to close the incisions. Using 6-0 nylon suture helps because the wounds dehisce with resorbable sutures.

Postoperatively, cephalexin, 500 mg, every 6 hours for 5 days are given. The patient is asked to ice the lips for 48 hours and refrain from excessive lip function for a week. Postoperative swelling is variable. Pre-operatively, patients must be made aware of this variable healing. Appropriate analgesics are prescribed for several days. The sutures are removed on the fifth postoperative day.

Expanded polytetrafluro-ethylene implants(ePTFE)

Lip augmentation can be obtained by the implantation of various synthetic materials, including polytetrafluoroethylene (PTFE; SoftForm), as well as biomaterials such as fascia, dermis, and decellularized donor dermis (AlloDerm).

ePTFE lip implants represent a new method of ePTFE technology and appear to be different from previous ePTFE products. The implants appear to work well when used for lip augmentation. Placement of these implants is simple, and as long as attention is focused on several important factors, the implants are predictable. Although most of these patients desire injectables such as Restylane, a certain segment of this population desires a more permanent option. ePTFE lip implants have proved to be an acceptable option by the surgeon and patient. The complication rate is low and the implants are serviceable. The procedure is reversible without extensive damage to normal tissue. The ePTFE lip implant appears to be a useful option in the armamentarium of the cosmetic oral and maxillofacial surgeon.

ePTFE lip augmentation consists of the enlargement and reshaping of operated cleft upper lips to improve their dimensional relation with the patient's nose, teeth, and surrounding facial structures. The appearance of the lips is determined by the spatial relation of the lip structures with the teeth in a 3-dimensional space and by their function during animation and speech.

Synthetic materials such as Gore-Tex/PTFE have been used successfully and allow for a controlled application with ease of use. Expanded tetrafluoroethylene is available in tubes of different sizes like 2.4-mm and 3.4-mm diameter. They are provided with a disposable applicator and implanted in the subdermal plane at the vermillion border.

Surgical Options

Surgical procedures involving advancement, lift, and roll are designed to enhance various parts of the lip anatomy using the patient's local tissues. Z-plasty, V-Y, and W advancement flaps are intended to project and fill the central and lateral parts of the vermillion. The flaps are designed on the oral-wet vermillion-mucosal aspect of the lip and dissected just superficial to the muscle, containing the mucosa and submucosal elements.

Lip lifts can be designed to shorten the distance between the Cupid's bow and the base of the columella, "lifting" the lip and enhancing the vertical height of the dry vermillion. Reshaping the lower lip also can be performed in this fashion.

Accurate preoperative planning is mandatory since even minor asymmetries are always clearly evident to the patient and observers. In addition, accurate psychological evaluation should focus on identifying patients with unrealistic expectations. Preoperative digital imaging or photo modifications can help in illustrating postoperative outcome and in operative planning.

Complications

Complications of collagen injections include allergic reaction to the compound, possible intravascular injection, skin slough, scarring, granuloma formation, and hematoma. Testing for sensitivity to bovine collagen must be performed prior to injection and observed for 4 weeks. Complications of fat transfer include donor site hematoma, scarring, infection, lumpiness, asymmetry, infection, hematoma, intravascular injection, and possible skin slough.

Complications of synthetic material implantation include infection, asymmetry, sensitivity to the material, extrusion, need for removal of the implant because of hardening, interference with lip function, and sensation changes.

SoftForm implants have been shown to produce better results with fewer complications. SoftForm does not shrink and is never absorbed into the body. Unlike the previous gore-tex implants, SoftForm is more tubal in form and has an outer porous ePTFE layer, allowing the tissue to network and grow "into it". Scar tissue forms on either end of the implant which allows it to remain in place and also allows it to easily be removed if it becomes infected. This type of lip augmentation is permanent but reversible.

Several reports in the literature have attested to the safety of ePTFEimplants. Significant postoperative swelling is common to all techniques of lip augmentation. The swelling usually resolves within 7-10 days, but it may persist for several weeks. Recommended postoperative care includes ice packs, sun avoidance, liquid diet, perioral care with saline rinses, and rest for 24-48 hours, depending on the extent of surgery. Patients are informed of the significant swelling and bruising that may develop with this procedure; usually, they are able to tolerate it well.

One of the most common complaints after surgical advancement is persistent numbness and/or paresthesia around the augmented lips. This problem usually resolves in 4-6 weeks but may become a significant nuisance for a small percentage of patients.

Complications seen with injectable fillers are usually minor, although as mentioned earlier, blindness has been reported after injecting near the periorbita. The main complications seen with fillers include the following: Intravascular injection Tissue necrosis, Bruising, Excessive swelling, Hematoma Bruising Needle tracks Asymmetry, Overfill, Underfill, Contour irregularities (lumpiness), Material visible through skin (injection too superficial), Herpes simplex activation .

Most of these complications represent minor or transient problems that Self-correct or improve. Intravascular injection can cause tissue necrosis. Necrosis can also be seen from vascular congestion from injections that compromise the dermal plexus. Sometimes, tissue blanching can be seen while injecting, which is usually transient, but in some cases, vascular refill does not happen and areas of tissue slough are seen. This situation can be prevented by paying attention to the plane of injection and not overinjecting or injecting with excessive pressure to produce blanching.

Occasionally, excessive swelling is seen after filler injection, especially in the lips. These patients usually respond well to heat, elevation, and tapering steroid treatment. Patients are forewarned that hyaluronic acid products produce more swelling than collagen products.

Complications of surgical advancement, lift, and roll include hypertrophic scarring, asymmetry, numbness, and lumpiness. In spite of proper precautions taken in terms of sterility of the working field and proper surgical techniques, minor complications do happen. The four most frequent complications seen are swelling, infection, movement and extrusion.

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